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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/629,780	07/31/2000	Yowjuang W. Liu	5251	4875

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EXAMINER

PIZARRO CRESPO, MARCOS D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 06/05/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/629,780

Applicant(s)

LIU ET AL.

Examiner

Marcos D. Pizarro-Crespo

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONEO (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 16-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

Attorney's Docket Number: 5251

Filing Date: 7/31/2000

Claimed Foreign Priority Date: none

Applicant(s): Liu et al.

Examiner: Marcos D. Pizarro-Crespo

DETAILED ACTION

This Office action responds to the application (Ser. No. 09/629,780) filed on 7/31/2000.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim 19 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

3. Claim 19 recites that the step of forming the source/drain regions comprises "a self-limiting diffusion process". The description in the original disclosure (pp.13/11.19) describes a "corner-limiting diffusion process", but fails to support the self-limiting diffusion process recited in claim 19.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

~~(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.~~

5. The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

6. Claims 16-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Lin (US 6127226).

7. Lin (see, e.g., figs. 1A-10) shows all aspects of the instant invention including a method for fabricating a semiconductor device with a trenched gate comprising:

- etching a trench **20** having substantially upright vertical sidewalls and a bottom surface in a semiconductor substrate **12**
- forming a trench-to-gate insulating layer **23** inside the trench **20**
- forming a trenched gate electrode **24** on the trench-to-gate insulating layer **23** inside the trench **20**
- forming source/drain regions **25** in the semiconductor substrate **12**
- forming an inter-gate dielectric layer **26** on a top surface of the trenched gate electrode **24**
- forming a control gate electrode **28** on a top surface of the inter-gate dielectric layer **26**

8. ~~Regarding claim 17, Lin shows that the step of forming a trenched gate electrode~~
further comprises the steps of:

- depositing a layer of polysilicon on the trench-to-gate insulating layer inside the trench (col.5/ll.40-42)
- planarizing the layer of polysilicon to substantially planar orientation with a top surface of the semiconductor substrate (col.5/ll.42-46)

9. Regarding claim 18, Lin's method further comprises a step of implanting the semiconductor substrate to form sidewall dopings **22** in the substrate **12** laterally spacing each of the source/drain regions **25** from the trench **20** (col.5/ll.17-21).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin in view of Kroger (US 4544937).

12. Regarding claim 19, Lin shows most aspects of the instant invention (see paragraphs 7-9 above), except for the step of forming the source/drain regions **25** comprising a self-limiting diffusion process. Lin differently performs ion implantation to form the source/drain regions (col.5/ll.17-21). Kroger, on the other hand, teaches diffusion and ion-implantation processes as equivalent doping techniques, both well known in the semiconductor art (col.6/ll.24-28). Moreover, a self-limiting diffusion

~~process is one of the most widely used methods of introducing controlled amounts of~~
impurities into a silicon substrate (col.6/ll.28-36).

Accordingly, it would have been obvious to one of ordinary skill in the art to substitute the ion-implantation step of Lin's source/drain regions by the self-limiting diffusion step suggested by Kroger in order to introduce controlled amounts of impurities into the silicon substrate.

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin in view of Wolf (US 3873371).

14. Regarding claim 20, Lin shows most aspects of the instant invention (see paragraphs 7-9 above). ~~Lin further shows sidewall dopings 22 formed in the substrate~~
~~12~~ after etching the trench 20. These sidewall dopings are ion implanted at angle (see, e.g., fig. 5B). Lin, however, fails to specify that the angle of implantation is approximately between 15-75°. Angle differences, however, are considered obvious design choices and are not patentable unless unobvious or unexpected results are obtained from these changes.

Wolf (col.2/ll.10-14), for example, teaches that the angle of implantation is a design variable that, if properly chosen, allows controlling the location at which the implanted impurities are introduced into the semiconductor substrate.

Accordingly, it would be an obvious matter of design choice to select a suitable angle for the ion implantation of Lin's sidewall dopings, as taught by Wolf, since the angle of implantation is a variable of importance subject to routine experimentation and

optimization and it is not inventive to discover the optimum or workable ranges by routine experimentation. *In re Aller*, 220 F.2d 454, 105 USPQ 233, 235.

Conclusion

15. Papers related to this application may be submitted directly to Art Unit 2814 by facsimile transmission. Papers should be faxed to Art Unit 2814 via the Art Unit 2814 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2814 Fax Center number is **(703) 308-7722** or **-7724**. The Art Unit 2814 Fax Center is to be used only for papers related to Art Unit 2814 applications.

16. Any inquiry concerning this communication or ~~earlier communications from the~~ examiner should be directed to **Marcos D. Pizarro-Crespo** at **(703) 308-6558** and between the hours of 9:00 AM to 7:30 PM (Eastern Standard Time) Monday through Thursday or by e-mail via Marcos.Pizarro@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

17. Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

Application/Control Number: 09/629,780 (Non-Final Rejection)
Art Unit: 2814

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18 ~~The following list is the Examiner's field of search for the present Office Action:~~

Field of Search	Date
U.S. Class / Subclass(es): 438/257-267, 257/314-326	5/30/2002
Other Documentation:	
Electronic Database(s): EAST (USPAT, EPO, JPO)	5/30/2002

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